

Satellites and Orbits: an Introduction

Student Reading Assignment

What is a Satellite?

A satellite is any smaller object that travels around a larger object. Satellites are either called natural or artificial. Natural satellites, like the Moon, are found in nature. The Moon is a satellite to the Earth just like the Earth is a satellite to the Sun. Artificial satellites are human-made spacecraft that are built and sent into space by people. These spacecraft can be crewed, such as the Space Shuttle, or unmanned, such as the National Aeronautics and Space Administration's (NASA's) Hubble Space Telescope.

The Benefits of Satellites

More than 3,500 satellites orbit the Earth today. Data from these satellites help make people aware of the environment, the world, and the universe they live in. Much of the information gathered by satellites shows us what is happening to our world. For example, satellites can be used to make accurate maps of Earth's surface, they help determine where vegetation is healthy or diseased, monitor weather, help with communications around the world, and they can help monitor pollution.

Satellite Orbits

Each satellite has a set path in space called an orbit. The speed and the angle with which a satellite is launched determine the satellite's orbit. Satellites are launched into a variety of orbits, depending on the satellite's purpose.

Types of Satellites

There are two main types of satellites, defined by their orbits. They are Polar-orbiting or Geostationary satellites. Polar-orbiting satellites travel in a circular path over the North and South Poles, so they can look at large portions of the Earth as it turns below them. Some weather satellites use this type of orbit to track the approach or development of a storm. Polar-orbiting satellites are placed into a Low Earth Orbit. They orbit at altitudes between about 100 and 1,000 miles above the Earth. Another type of satellite is the Geostationary satellite. Geostationary satellites orbit the Earth at altitudes of about 22,240 miles above the Equator. Seen from Earth, the satellite appears to be floating over a fixed spot on the Equator. Geostationary satellites are primarily used for observing weather and for worldwide communications.

Polar-Orbiting Weather Satellites

Weather satellites produce images and data that are important for predicting where and when tropical storms, hurricanes, floods, ocean storm waves, and forest fires may strike. Knowing this information in advance allows time to prepare for these events and avoid disaster. Weather satellite information may warn fruit tree farmers of frost. An accurate weather forecast also can allow engineers to schedule the best time for construction of large projects, such as bridges, highways, and dams.

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The Television Infrared Observation Satellite (TIROS) was the first series of meteorological satellites to carry television cameras to photograph the Earth's cloud cover. The first TIROS satellite was launched by NASA in 1960. Shortly after the launch of the first TIROS, the Department of Defense (DoD) began launching its own series of Low Earth Orbit weather satellites to support the military. These Defense Meteorological Satellite Program (DMSP) satellites were launched to fly in front of reconnaissance satellites to identify cloud-free areas of interest suitable for high resolution photography.

Nimbus, a second-generation meteorological satellite, named for a cloud formation, was larger and more complex than the TIROS satellites. Nimbus 1 was launched in 1964 and carried two television cameras and two infrared cameras. Although Nimbus 1 had only about a one-month life span, the satellite tracked the storm pattern of Hurricane Cleo as it moved through the Caribbean towards Florida, helping to prevent severe damage.

In December 1970, the TIROS and Nimbus satellites were replaced by the first satellite in the series of Polar-orbiting Operational Environmental Satellites (POES) operated by the National Oceanic and Atmospheric Administration (NOAA). The series of measurements of the Earth's air, land, water, and near-space environment that began with NOAA-1 in 1970 continues today, 35 years later, with NOAA-18 that was recently launched on May 20, 2005.

Satellites will continue to help improve life on Earth. Around the globe, satellites put persons and their computers on the information highway. Take an opportunity on the next clear night and look at the stars. If you notice one slowly moving across the sky, it may be one of the thousands of satellites serving us all. For satellites and the future, the sky is the limit.